"A VEHICLE SEAT"

THE PRESENT INVENTION relates to a vehicle seat and more particularly relates to a vehicle seat provided with a headrest arrangement intended to provide protection for the occupant of the seat in the event that a rear impact should occur.

If a vehicle is involved in a rear impact, for example if the vehicle is struck from behind, the chassis of the vehicle is given a very sudden forward acceleration. The squab of a seat mounted in the vehicle and also the back rest of the seat will, consequently, move forwardly with a very swift acceleration, thus imparting the same acceleration to the buttocks and torso of an occupant of the seat.

However the head of the occupant, which will have a substantial mass, is not contacted by any part of the seat and will thus remain stationary. Consequently the thorax of the seat occupant will move forwardly, whilst the head remains stationary, initially distorting the neck of the seat occupant. Subsequently, an acceleration will be imparted to the head of the occupant, by the occupant's neck, the acceleration initially being a rotational acceleration about the centre of gravity of the head, and subsequently being a forward acceleration that will accelerate the entire head of the seat occupant forwardly.

This may impart substantial stress to the neck of the seat occupant giving rise to so called "whiplash" injuries.

Various proposals have been made to provide a headrest which, in response to a rear impact, moves forwardly so as to engage the rear part of the head of the seat occupant. Provided that the headrest moves forwardly sufficiently early during a rear impact situation, the head of the occupant may be engaged in such a way that the head of the occupant is given an acceleration which is virtually identical to the acceleration imparted to the buttocks and thorax of the seat occupant. In this way the head of the occupant will move almost simultaneously with the torso, and thus only a minimum distortion of the neck will occur, thereby reducing the likelihood of serious "whiplash" injuries.

It has been proposed to provide a headrest on a vehicle seat, the headrest being pivotally mounted in position and being associated with a pressure plate located in the backrest of the seat, so that if the torso of the seat occupant is driven rearwardly into the backrest, the pressure plate moves rearwardly causing the pivotally mounted headrest to move forwardly into engagement with the back of the head of the seat occupant.

Typically such prior arrangements are relatively complex, and, in many cases a pivot bearing is provided.

The present invention seeks to provide an improved vehicle seat.

According to the present invention, there is provided a vehicle seat provided with a squab, a backrest and a headrest, the headrest being supported by a support element connected by a connection to a drive element, the drive element being connected to a pressure plate within the backrest and being

guided for rearward movement by a guide fast with the frame of the seat, there being a pivot surface located adjacent the support element such that on rearward movement of the drive element the support element engages the pivot surface to cause the headrest to pivot forwardly.

Preferably, a stop element is provided located in front of part of the support element to restrict forward movement of the headrest.

Advantageously, a resilient biasing member is provided to bias the headrest to an initial position.

Conveniently, the pivot surface is convex.

Preferably, the pivot surface is concave.

Advantageously, the support element is provided with a convex part corresponding to the concave pivot surface, the convex part being received within the concavity of the convex pivot surface.

Conveniently, the connection between the drive element and the support element is a stud and aperture connection.

Preferably, the drive element, the connection, and the support element are formed integrally.

Advantageously, the drive element, the connection and the support element are all formed from a single metal bar.

Conveniently, means are provided to prevent rearward movement of the headrest following a forward pivotal movement of the headrest.

Preferably, the means to prevent rearward movement comprise a ratchet arrangement co-operating with the drive element.

Advantageously, at least one further drive element, connection and support element are provided associated with the headrest.

In order that the invention may be more readily understood, and so that further features thereof may be appreciated, embodiments of the invention will now be described, by way of example, with reference to the accompanying drawings in which:

FIGURE 1 is a perspective view of a vehicle seat, parts of the seat being shown in phantom and parts being shown cut away;

FIGURE 2 is a schematic side part sectional view of part of the seat shown in Figure 1;

FIGURE 3 is a perspective of part view of an alternative form of seat frame for use in another embodiment of the invention;

FIGURE 4 is a diagrammatic sectional view corresponding generally to Figure 2 illustrating a modified embodiment of the invention in an initial position;

FIGURE 5 is a view corresponding to Figure 4 but illustrating the position occupied by the components of the headrest assembly after a rear impact;

FIGURE 6 is a view corresponding to Figure 4 illustrating a further alternative embodiment of the invention; and

FIGURE 7 is a view corresponding to Figure 5 illustrating the embodiment of Figure 6 in the position that it will occupy after a rear impact.

Referring initially to Figure 1, a vehicle seat 1 is, illustrated which has a squab 2 (shown in phantom) and a backrest 3 (also shown in phantom).

Associated with the backrest 3 is a headrest 4, the headrest 4 being illustrated located at an initial position above the upper part of the backrest 3.

Within the backrest 3 of the seat, there is provided an inverted U-shaped seat frame 5. Inverted U-shaped seat frames are typical for front seats of a motor vehicle, but can also be provided within the rear seats. The frame 5 has two upwardly extending side arms 6, 7 interconnected by a substantially horizontal upper cross piece 8. The arms 6, 7 and the cross piece 8 may all be formed of hollow square or rectangular sectioned metal tubing.

Mounted on the cross piece 8 is a inverted U-shaped blocking member 9, the blocking member 9 having two arms 10, 11 extending generally upwardly from the cross piece. The two arms 10, 11 are interconnected by a base 12. The blocking member 9 is a formed of a rod or tube of circular cross section and the forwardmost face of the base 12 forms (as will become clearer from the following description) a convex pivot surface 13. As illustrated in Figure 2, the

two arms 10, 11 of the blocking member 9 are slightly arcuate such that the base 12 and the associated pivot surface 13 are located slightly rearwardly of the frame 5.

The cross piece 8 of the frame 5 defines two spaced apart guide passages 14, 15 or circular section. The guide passages 14, 15 extend in the forward-rearward direction of the seat.

The guide passages 14, 15 receive respective drive elements 16, 17, the forwardmost ends of the drive elements 16, 17 supporting a pressure plate 18 which is located within the backrest 3 of the seat 1.

It will be understood that pressure applied to the pressure plate 18, by the torso of an occupant of the seat in a rear impact situation, will tend to move the drive elements 16, 17, and such movement will be guided to be a rearward movement by the guide passages 14, 15.

The drive elements 16, 17 pass through the guide passages 14, 15 to the rearside of the frame 5, where the drive elements 16, 17 are connected, by connections 19, 20 to the lower ends of two support elements 21, 22 which extend generally upwardly, past the base 12 of the blocking member 9, to engage and support the headrest 4.

It is to be noted that in the described embodiment the drive element 17, the connection 20 and the support element 22 are all formed integrally as a bent metal rod. The connection 20 is formed by a bent region of the rod, and, as will be described hereinafter, this region of the rod will become deformed in a rear impact situation. Similarly, the other drive element 16, connection 19 and

support element 21 are all formed integrally in the same manner. Alternatively, the connections 19, 20 can take the form of hinges.

If the seat 1 as described with reference to Figures 1 and 2 is occupied by a seat occupant, and the vehicle, in which the seat is mounted, is involved in a rear impact, the squab 2 and backrest 3 of the seat will move forwardly, thus imparting a sudden acceleration to the buttocks and torso of the seat occupant. The torso of the seat occupant will exert a reactionary force on the pressure plate 18, tending to move the pressure plate 18 rearwardly, towards the frame 5 within the backrest 3 of the seat. As the pressure plate 18 moves rearwardly, so the drive elements 16, 17 are also moved rearwardly, relative to the backrest of the seat, the drive elements 16, 17 being guided in this rearward movement by the guide passages 14, 15.

As the drive elements 16, 17 move rearwardly as described above, so the associated support elements 21, 22 are driven rearwardly until contact is established between each support element 21, 22 with the convex pivot surface 13 provided on the base 12 of the blocking member 9. Further rearward movement of the drive elements 16, 17 will cause the headrest 4 to pivot forwardly, as indicated by the arrow 23 in Figure 2, thus bringing the headrest 4 into engagement with the rear part of the seat occupant's head. It is believed that this will minimise any risk of whiplash injuries occurring to the seat occupant.

The support elements 21, 22 can be configured so as to be deformable such that they perform a energy absorption function in the event of an accident. As the head of the seat occupant is urged against the headrest 4, the support elements 21, 22 can deform, thereby absorbing energy and further reducing the risk of injury.

Figure 3 illustrates a modified form of frame 5 in which two tubular guide elements 24, 25 are secured to the cross piece 8 of the frame, the tubular guide elements 24, 25 each defining a passage corresponding to the guide passages 14, 15 of the embodiment described with reference to Figures 1 and 2. It should therefore be appreciated that in both of the above described embodiments, the guide passages are fast with the frame.

Turning now to Figures 4 and 5, in a modified embodiment of the invention, the cross piece 8 of the frame 5 is provided with an upstanding support pin 26 which supports, at its upper end, a blocking element 27. The blocking element 27 includes a rear part 28, the forward face of the rear part having a recessed pivot surface 29 of generally concave configuration. Located in front of the rear part 28 is a stop element 30 which is fixed in position relative to the cross piece 8.

The cross piece 8 defines a guide passage 15 (again fast with the frame 5) which accommodates a drive element 17, the drive element 17 being connected, at its forwardmost end, to a pressure plate 18.

Present within the cross member 8 is a ratchet arrangement 31, illustrated schematically. The ratchet arrangement 31 is provided to engage serrations (not shown) provided on the drive element 17 to prevent the drive element 17 moving forwardly after the drive element 17 has been moved rearwardly in the event of a rear impact.

The rearmost end of the drive element 17 is provided with a connecting stud 32 having an aperture through which the lowermost part of a support element 33 to slidingly connect the support element 33 to the drive element 17.

The support element 33 extends upwardly from its point of connection to the drive element 17, passing through the space defined between the rear part 28 of the blocking element 27 and the stop element 30. Part 34 of the support element 33 extends past the concave pivot surface 29, the part 34 being of corresponding convex form, with the convex part 34 being snugly received within the concavity of the concave pivot surface 29. The uppermost part of the support element 33 supports the headrest 4.

A biasing member in the form of a leaf spring 35 is provided, one part 36 of the leaf spring being mounted on the uppermost part of the cross piece 8, the other end 37 of the leaf spring engaging part of the support element 33 at a position above the blocking element 27.

The leaf spring 35 serves to bias the headrest 4 to a rearwardmost initial position, with the pressure plate 18 being located in a forward position.

Should a vehicle incorporating a seat having a headrest arrangement of the type shown in Figure 4 be involved in a rear impact, a reactive force will be applied to the pressure 18 by the torso of the seat occupant thus moving the drive element 17 rearwardly through the guide passage 15.

As the drive element 17 moves rearwardly, so the connection between the rearwardmost end of the drive element 17 and the lower part of the support element 33 moves rearwardly. The support element 30 is thus urged upwardly, such that its lower part slides through the aperture provided in the connecting stud 32. As a consequence of the engagement of the convex part 34 of the support element 33 with the concavity of the pivot surface 29 a pivoting motion is effected against the bias provided by the leaf spring 35. Thus the headrest 4 moves forwardly and slightly upwardly to the position shown in Figure 5.

Forward movement of the headrest 4 is limited by engagement of part of the support element 33 with the stop element 30.

This engagement of the support element 33 with the stop element 30 also prevents the headrest 4 moving forwardly inadvertently should luggage from the rear part of the vehicle strike the headrest 4 in a frontal impact situation.

It is to be understood that the ratchet arrangement 31 will serve to retain the drive element 17 in the final position that it occupies, as shown in Figure 5, thus preventing subsequent rearward movement of the headrest 4.

Turning now to Figures 6 and 7 of the accompanying drawings a further embodiment is illustrated which is very similar to the embodiment of Figures 4 and 5 save that the pivot surface 29 defined by the rear part 28 of the blocking element 27 is of convex form and the part of the support element 33 extending between the rear part 28 of the blocking element 27 and the stop element 30 is linear. It should thus be understood that when a headrest arrangement of the type shown in Figures 6 and 7 is actuated, the linear part of the support element 33 will effect a "rolling" pivotal action about the convex pivot surface 29, enabling the headrest 4 to move to a forward position as shown in Figure 7.

It should also be appreciated that in each of the above described embodiments the headrest 4 is effectively supported above the uppermost part of the backrest 3 by virtue of the engagement between the or each guide element and the or each respective guide passage. It will therefore be seen that the arrangements do not require a pivot bearing to support the headrest whilst also permitting its pivotal movement.

In the present Specification "comprises" means "includes or consists of" and "comprising" means "including or consisting of".

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